NON-PUBLIC?: N
ACCESSION #: 8811160573
LICENSEE EVENT REPORT (LER)

NAME: Rancho Seco Nuclear Generating Station PAGE: 1 OF 6

DOCKET NUMBER: 05000312

TITLE: Reactor Trip Due to a Grid Disturbance
EVENT DATE: 10/14/88 LER #: 88-015-00 REPORT DATE: 11/11/88

OPERATING MODE: N POWER LEVEL: 092

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Steven W. Rutter, Supv.,
Independent Investigation/Reviews TELEPHONE: (915)452-3211

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE TO NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

At 0614 hours on October 14, 1988, while the plant was at 92% power,a transmission line phase to phase voltage imbalance fault caused the loss of two reactor coolant pumps. This caused the automatic actuation of the Reactor Protection System on power level to number of pumps running logic, tripping the reactor. This constitutes an automatic actuation of an Engineered Safety Feature.

Concurrent with the reactor trip, the other two reactor coolant pumps tripped on phase imbalance and the Emergency Feedwater Initiation and Control System initiated auxiliary feedwater flow. This constitutes an automatic actuation of an Engineered Safety Feature. Natural circulation cooling was established and maintained until "D" reactor coolant pump was started at 0742 hours. By 0830 hours, all reactor coolant pumps were running and the plant was in the normal post trip window.

At 0344 hours on October 15, 1988, almost simultaneous ground faults on incoming transmission lines caused a momentary degradation of electrical power at Rancho

Seco. This caused two Safety Features Valves to close. This constitutes an automatic actuation of an Engineered Safety Feature.

The actuations of the Engineered Safety Features are reportable pursuant to 10 CFR 50.73(a)(2)(iv). To prevent a reoccurrence of the October 14 trip, the phase to phase fault protection was extended past Stagg substation.

END OF ABSTRACT

Description of the Event

(All events which occurred within the Pacific Gas and Electric (PG&E) system have not been confirmed by District personnel.)

Event Summary

At about 0400 hours on October 14, 1988, the Oil Circuit Breakers (OCBs) 240. and 340 at the Rancho Seco switchyard feeding the Stagg-Tesla transmission line tripped open on a phase to ground fault. At the same time, OCB 282 at Tesla substation tripped open, isolating the Rancho Seco-Stagg-Tesla transmission line (see Figure 1). OCB 222 at Stagg substation failed to open.

At about 0430 hours, PG&E reclosed OCB 282 at Tesla, reenergizing the Tesla to Stagg transmission system. At about the same time, Rancho Seco transferred Reactor Coolant Pump (RCP) bus 6B from Startup Transformer No. 1 to the Unit Auxiliary Transformer No. 1 as required by Operating Procedure A.57 when there is only one source of power to the Startup Transformer No. 1.

At 0530 hours, Rancho Seco closed OCBs 240 and 340, energizing the Stagg-Tesla transmission line from the SMUD end. Unknown at the time (since Stagg is a small unmanned substation), the trip coil for OCB 222 was burned out when the breaker failed to trip at 0400. This prevented the breaker from tripping open during the subsequent fault situation.

At 0614 hours, the transmission line between Tesla and Stagg substations developed a phase to ground fault. This fault was similar to the fault that occurred at 0400 hours.

The phase to ground fault lasted about 1 second, became a two-phase fault for about 1 second, then developed into a three-phase imbalance fault. The Stagg protective relaying sensed the fault was between Stagg and Tesla and sent a signal to OCB 222 at Stagg to trip open. Because OCB 222's trip coil was burned out and the Stagg substation does not have breaker failure protection, and since Rancho Seco's Zone 2 phase to phase relay protection could not sense the fault,

the plant stayed locked into
the fault for about 41 seconds. After 41 seconds
the fault cleared on its own.

The fault caused a phase to phase voltage imbalance which in turn disrupted Rancho Seco's electrical system, causing all four RCPs to trip on phase imbalance. B RCP tripped 20 seconds into the event, followed by D RCP 5 seconds later. This automatically actuated the Reactor Protection System on power level to number of pumps running logic. Approximately 1 second later, A and C RCPs tripped on phase imbalance. This constitutes an automatic actuation of an Engineered Safety Feature and is reportable pursuant to 10 CFR 50.73(a)(2)(iv).

The Emergency Feedwater Initiation and Control (EFIC) System actuated on loss of all four RCPs and natural circulation cooling (decay heat removal) was established. This constituted an automatic actuation of an Engineered Safety Feature and is reportable pursuant 10 CFR 50.73(a)(2)(iv). The plant remained stable and within the natural circulation post trip window until 0742 hours when the D RCP was started. By 0830 hours all four RCPs were running and the plant was in the normal post trip window.

At 0344 hours on October 15, 1988, while the plant was in hot shutdown, two almost simultaneous faults on incoming transmission lines caused a momentary degradation of electrical power at Rancho Seco. The incoming breakers tripped open on ground faults and fast reclosed approximately 25 cycles (-.5 seconds) later. This caused about a 45% degradation in plant voltage. Low voltage alarms were recorded on all of the plant's battery chargers and two Safety Features Valves closed.

Safety Features Valves SFV-53615, Reactor Building Radiation Monitor Sample Supply, and SFV-53616, Reactor Building Radiation Monitor Sample Return, are normally open, air operated valves. The air supply to keep these valves open is directed through two normally energized solenoid valves, SFY-53615 and SFY-53616. During the voltage transient, the relays for the solenoid valves dropped out, deenergizing the solenoid valves. This caused SFV-53615 and SFV-53616 to close, which is their safety features position. The valves were manually reopened 4 minutes after they closed. This constituted an automatic actuation of an Engineered Safety Feature and is reportable pursuant to 10 CFR 50.73(a)(2)(iv).

FIGURE OMITTED - NOT KEYABLE - DIAGRAM

Sequence of Events

October 14, 1988

03:57:03 Stagg-Tesla line OCBs 240 and 340 trip at Rancho Seco.

03:59:00 Stagg-Tesla line OCB 282 at Tesla trips and OCB 222 at Stagg fails to trip.

The OCB 282 trip is caused by a phase to ground fault in the transmission line between Stagg and Tesla.

04:08 The ground fault relay is reset at Rancho Seco on Stagg-Tesla line breaker.

04:30 PG&E recloses OCB 282 at Tesla.

04:30 RCP bus 6B is transferred to Auxiliary Transformer No. 1 per procedure A.57 while Stagg-Tesla line is down.

05:30:18 SMUD recloses Stagg-Tesla line OCB 340 at dispatcher's request.

05:30:37 SMUD recloses Stagg-Tesla line OCB 240 at dispatcher's request.

06:14:05 The transmission line between Tesla and Stagg develops a phase to ground fault. This lasts for about 1 second, becomes a two-phase fault for about 1 second, then develops into a three-phase imbalance fault. OCB 222 at Stagg does not open because it strip coil was burned out during the earlier event. Stagg substation does not have breaker failure protection and Rancho Seco's phase to phase fault protection does not extend past Stagg.

Rancho Seco's Zone 2, relay protection does not sense the fault and feeds it for about 41 seconds.

06:14:25 B RCP trips on phase imbalance.

06:14:30 D RCP trips on phase imbalance.

06:14:30 All four Reactor Protection channel strip on power-to-pumps.

06:14:31 Turbine Generator trip; OCBs 220 and 230 open.

06:14:31 A and C RCPs trip on phase imbalance.

RCP 6.9 kV buses fast transfer to Startup Transformer No. 1, but all RCPs have already tripped due to voltage phase imbalance.

06:22 Auxiliary Feedwater (AFW) Pump P-318 secured.

06:26 Secured B Main Feedwater (MFW) Pump and closed pegging steam valve.
06:38 Secured B and C Condensate Pumps; EFIC controlling flow.

06:43 Operations attempts to start D RCP but the pump will not start because the 86 Lockout on 646 relay had not been reset.

07:05 Reactor Building Drain Accumulation Tank dumped.

07:15 Notification made to NRC.

07:42 Cleared 86 Lockout and started D RCP.

07:49 Started making up to Condensate Storage Tank.

07:55 Started B RCP.

07:58 Secured B and D RCP Auxiliary Lube Oil Pumps; updated NRC on Red Phone.

08:19 Secured A and B Nuclear Service Raw Water Pumps.

08:21 Started A RCP.

08:27 Secured A RCP Auxiliary Lube Oil Pump.

08:30 Started C RCP.

08:42 Commenced swapping feedwater from EFIC control to MFW control.

08:44 Blowdown of OTSG established per procedure B.4.

09:04 Secured AFW Pump P-319; transfer back to MFW complete.

09:30 High speed reclosures reinstated to all 300 series OCBs except for OCB 340.

October 15, 1988

03:44 Simultaneous ground faults occur on the Rancho Seco-Hedge #2 line and the Rancho Seco-Bellota #2 line.

03:44+5
cycles Rancho Seco OCBs 320, 250, and 350 trip open; SFV-53615 and SFV-53616 close.

03:44+30
cycles OCBs 320 and 350 fast reclose.

Cause of the Event

In the early morning of October 14, 1988, the central Sacramento Valley received the first rain of the season. Problems with transmission line insulators caused line flashovers in the PG&E and SMUD transmission systems over the next two days. The transmission line faults were the cause of the events discussed above.

Plant Operating Conditions Prior to the Events

Prior to the reactor trip on October 14, 1988, Rancho Seco was operating at 92% power, producing 862 MWe. All four RCPs were powered from the Unit Auxiliary No. 1 transformer. "B" High Pressure Injection Pump was out of service for maintenance.

Prior to the momentary degradation of site power on October 15, 1988, Rancho Seco was in Hot Shutdown following the reactor trip on the previous day.
Safety Consequences of the Events

There were no safety consequences to these events. The response of the plant to the loss of all RCPs was per design. The EFIC System responded as designed to the loss of all RCPs. All Engineered Safety Features responded as required during the plant trip and recovery.

The closure of the Safety Features Valves during the degraded voltage event did not represent a safety hazard because the valves went to their safety features position.

Corrective Actions

To prevent the reoccurrence of the October 14, 1988 trip, the phase to phase fault protection has been extended past the Stagg substation to Tesla.
Previous Similar Events

On December 22, 1982, Rancho Seco tripped due to grid frequency fluctuations.

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
P. O. Box 15830, Sacramento CA 95852-1830, (916) 452-3?11

AN ELECTRIC SYSTEM SERVING THE HEART OF CALIFORNIA

CEO 88-322

November 11,1988

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Docket No. 50-312
Rancho Seco Nuclear Generating Station
License No. DPR-54
LICENSEE EVENT REPORT 88-15: REACTOR TRIP DUE TO A GRID DISTURBANCE

A
tention: George Knighton

In accordance with the requirements of 10 CFR50.73(a)(2)(iv), the Sacramento Municipal Utility District hereby submits Licensee Event Report 88-15.

Members of your staff with questions requiring additional information or clarification may contact Mr. Steven W. Rutter at (916) 452-3211, extension 4674.

Sincerely,

Joseph F. Firlit
Chief Executive Officer
Nuclear

Attachment

cc w/atch: A. D'Angelo, NRC, Rancho Seco
J. B. Martin, NRC, Walnut Creek(2)
INPO

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*** END OF DOCUMENT ***

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